

CURRICULUM VITAE

RAJAN GUPTA

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Nationality: USA

EDUCATION:

M.S. in Physics, University of Delhi, Delhi, India
Ph.D. in Theoretical Physics, 1982, California Institute of Technology

PROFESSIONAL DEVELOPMENT:

Research Professor, Electrical and Computer Engineering, Univ. of New Mexico, 2009-
Group Leader, Elementary Particles and Field Theory (T-8), LANL, 2001-2008
Program Manager for High Energy Physics at LANL, 2000–Present
Visiting Lecturer, Caltech, April-June, 1991.
Staff Scientist, T-8, Los Alamos National Laboratory, 1988–Present
Guest Professor, University of Wuppertal, March-April 1987.
J. Robert Oppenheimer Fellow; Los Alamos National Laboratory: 1985-1988
Honorary Post-doctoral fellow at Harvard University: 1983-1986
Post-doctoral fellow at Northeastern University: 1982-1985

AWARDS:

Elected Fellow of Los Alamos National Laboratory, 2006
PI, DoE allocation at NERSC, 2001 – 2005
Distinguished Performance Award, LANL, 1999
PI, DoE Grand Challenges Award (ACL at LANL, NERSC), 1997 – 2000
PI, DoE Grand Challenges Award (ACL at LANL), 1992 – 1996
Elected Fellow of American Physical Society, 1994
PI, DoE Grand Challenges Award (NERSC), 1988 – 1991
J. Robert Oppenheimer Fellow, LANL, 1985 – 1988
National Science Talent Scholarship, India, 1970 – 1975

TEACHING EXPERIENCE:

Taught Graduate Course in Physics 229c, CALTECH Spring 1991
Instructor for Undergraduate Physics: Northeastern University 1982-1985
Instructor for Undergraduate Physics: CALTECH 1977-1982

Funding and Grants Since 2000

- [1] LDRD 20110043-DR “Probing New Interactions with Neutron Beta Decay”.
PI: Vincenzo Cirigliano and Mark Makela
Duration: 2011-2014: \$5 Million
Gupta Share: \$120,000 per year.
- [2] LDRD 20100030DR, “Optimization and Control Theory for Smart Grids”.
PI: Misha Chertkov (LANL)
Duration: 2010-2013: \$5 Million
Gupta: \$100,000 per year.
- [3] DOE Stimulus Funding, “Regional Climate Impacts”.
PI: James Bossart (LANL)
Duration: 2010-2012: \$5 Million
Gupta: \$100,000 per year.
- [4] Berkeley Nuclear Research Center “UC Berkeley LANL Collaboration”.
PI: Sara Scott (LANL) and Jasmina Vujic (UC Berkeley)
Duration: 2009-2011: \$2 Million
Gupta: \$40,000 per year.
- [5] DOE KA1401020, “High Energy Physics”.
PI: Rajan Gupta (LANL)
Duration: 2008-2011: \$300,000 per year
Gupta: \$60,000 per year.
- [6] LDRD 20060340ER, “Multigene Correlations and Their Implications for Cardiovascular Disease”.
PI: Rajan Gupta (LANL)
Duration: 2006-2009: \$280,000 per year
Gupta: \$140,000 per year.
- [7] DOE KA1401020, “High Energy Physics”.
PI: Rajan Gupta (LANL)
Duration: 2006-2008: \$250,000 per year
Gupta: \$62,500 per year.
- [8] DOE KA1401020, “High Energy Physics”.
PI: Rajan Gupta (LANL)
Duration: 2000-2006: \$500,000 per year
Gupta: \$85,000 per year.
- [9] LDRD 2000048ER, “CP Violation in Kaon Decays”.
PI: Rajan Gupta (LANL)
Duration: 2000-2003: \$280,000 per year
Gupta: \$140,000 per year.
- [10] DOE KA1401020, “Research in Elementary Particles and Field Theory”.
PI: Geoffrey West (LANL)
Duration: 1988-2000: \$425,000 per year
Gupta: \$65,000 per year.

Post-docs Mentored in Theoretical Physics at Los Alamos

- [1] David Daniel (1990-1993)
Current Position: Staff Scientist and Deputy Group Leader, Los Alamos National Laboratory.
- [2] Tanmoy Bhattacharya (1992-1995)
Current Position: Staff Scientist, Los Alamos National Laboratory.
- [3] Jeffrey Grandy (1992-1994)
Current Position: Staff Scientist, Lawrence Livermore National Laboratory.
- [4] Weonjong Lee (1997-2002)
Current Position: Associate Professor, Seoul National University, South Korea.

Post-docs Mentored in Computational Physics at Los Alamos

- [1] Pablo Tamayo (1992-1994)
Current Position: Senior Computational Biologist, Broad Institute, Cambridge, MA.

Master's Thesis Students Supervised at the University of New Mexico

- [1] Harihar Shankar, ECE Department, UNM (2008-2009)
Current Position: Staff Scientist, Los Alamos National Laboratory.
- [2] Rathesh Prabhu Rajendran, Computer Science Department, UNM (2008-2009)
Current Position: Software Development Engineer, Microsoft Corporation.
- [3] Parthiban Jayabal, ECE Department, UNM (2008-2009)
Current Position: Software Developer, Symplicity Corporation.
- [4] Padampriya Palanisamy, ECE Department, UNM (2009-2010)
Current Position: Software Engineer, Google.

Staff Scientists Recruited at Los Alamos

- [1] Paul Ginsparg (1989-2000)
Current Position: Professor, Cornell University.
- [2] David Daniel (1990-1993, 2001–Present)
Current Position: Staff Scientist, Computing Division, Los Alamos National Laboratory.
- [3] Tanmoy Bhattacharya (1992–Present)
Current Position: Staff Scientist, Los Alamos National Laboratory.
- [4] John Terning (2000-2005)
Current Position: Professor, University of California, Davis.
- [5] Michael Graesser (2006–Present)
Current Position: Staff Scientist, Los Alamos National Laboratory.
- [6] Ryuchiro Kitano (2006-2008)
Current Position: Professor, Tohoku University, Japan

SERVICE : Conferences/Workshops Organized In HEP

- [1] Organizer, First Workshop on MONTE CARLO RENORMALIZATION GROUP METHODS, Cornell July 1985.
(with K. G. Wilson).
- [2] Convener “Session on Lattice Gauge Theory”: 1988 DPF conference, Storrs, Connecticut (August 1988).
- [3] Convener “Session on Lattice QCD and theoretical aspects of QCD:” QUARK MATTER 88, Lennox, Massachusetts (Sept. 1988).
- [4] Member, International Advisory Committee, LATTICE 90, Tallahassee, Florida, 1990.
- [5] Director, 1994 Santa Fe Workshop, “LARGE SCALE NUMERICAL STUDIES OF QCD” July 25 - August 12, 1994
- [6] International Advisory Committee, LATTICE 97, Edinburgh, Scotland, 1997.
- [7] Scientific Director, 1997 Les Houches Summer school on “PROBING THE STANDARD MODEL OF PARTICLE INTERACTIONS”, Les Houches, France, 1997.
- [8] Member, Local Organizing Committee, LATTICE 98, Boulder, Colorado, 1998.
- [9] Director, 1998 Santa Fe Workshop, “Perturbative and Non-perturbative Aspects of the Standard Model”, July 27 - August 14, 1998.
- [10] Organized ROSENFEST, Oct 31-Nov 1, 1998, Santa Fe. Symposium to celebrate the 65th birthday of Peter Rosen.
- [11] Convener “Plenary session on Lattice QCD” at the APS Centennial Meeting, Atlanta, Georgia, March 20-26, 1999.
- [12] Member, International Advisory Committee, LATTICE 99, Pisa, Italy, 1999.
- [13] Convener, Session on “Quark Masses” at DPF 2000, The Ohio State University, August 2000.
- [14] Member, Local Organizing Committee, LATTICE 00, Bangalore, India, August, 2000.
- [15] Co-organizer “Modeling the QCD Equation of State at RHIC” LLNL, Livermore, CA, Feb. 2006.

SERVICE : Conferences/Workshops Organized Outside HEP

- [1] Organizer, “SCALING LAWS IN PHYSICS AND BIOLOGY”, Symposium in honor of Geoffrey West, Santa Fe, Dec 2000
- [2] Principal organizer, “CONFRONTING TERRORISM — CT2002”, Los Alamos National Laboratory, March 2002. (<http://library.lanl.gov/ccw/ct2002/>)
- [3] Director, “CONFRONTING TERRORISM — CT2005”, Los Alamos National Laboratory, January 2005.
- [4] Organizer, “Socio-technical systems: Bridging the scales”, 26th annual CNLS conference, 14-17 August 2006. (http://cnls.lanl.gov/External/annual_conference.2006.php)
- [5] Co-organizer, “Workshop on Volunteered Geographic Information”, University of California Santa Barbara, 13-14 December, 2007, (<http://ncgia.ucsb.edu/projects/vgi/>)
- [6] Co-organizer, “Energy for the 21st Century”, 29th Annual CNLS Conference, Santa Fe, May 18-22, 2009 (<http://cnls.lanl.gov/annual29/>)

SERVICE : TO LOS ALAMOS NATIONAL LABORATORY

- [1] Played a significant role in the development of parallel computing at LANL. Starting with the Floating Point T200 in 1986, and then the Thinking Machines CM2 and CM5 supercomputers (1989-1996), showed that for large scale scientific computing parallel computing was the way of the future.
- [2] Member, LDRD ER review committee
- [3] Member, Post-doctoral review committee
- [4] Member, Search Committee for Theoretical Division Director, LANL, 1998-1999
- [5] Member, LANL Director's Colloquium Committee, 2000 – 2002
- [6] Chair, LANL Director's Colloquium Committee, 2003-
- [7] Member, LANL Research Environment Advisory Committee, 2000-2002
- [8] Organizer, LANL Forum on International Security in the New Millenium, 2000-2006
- [9] Member, Institutional Computing Steering Committee, LANL, 2002-
- [10] Chair, LANL A-team (Science Advisory Committee to the Director), 2004-2006
- [11] Chair, LANL Energy Council 2006-2007
- [12] Member, Leadership Team, Energy Security Center, LANL, 2008-

SERVICE : EDITORIAL APPOINTMENTS

- [1] Editor, "High Speed Computing", World Scientific, 1990-
- [2] Divisional Associate Editor, *Physical Review Letters*, "Particles and Fields", 2000-2002.

PUBLICATIONS IN ELEMENTARY PARTICLE PHYSICS

- [1] Beyond Leading Order QCD Perturbative Corrections to the Pion Form;
(with R.D. Field, S. Otto and L. Chang).
Nuclear Physics **B186** (1981) 429.
Citations: 91
- [2] Optimized Perturbation Theory: The Pion Form Factor.
Proceeding of the Conference on Perturbative QCD at Florida State University, Tallahassee; 1981, American Institute of Physics 1981.
- [3] Hadron Spectrum, Spontaneous Breaking of $Z(3)$ and Fake Loops in Lattice $SU(3)$;
(with A. Patel).
Physics Letters **B124** (1983) 94.
Citations: 43
- [4] Calculation of the Hadron Masses in Lattice QCD
(with A. Patel).
Nuclear Physics **B226** (1983) 152.
Citations: 34
- [5] Exotic Mesons in Lattice QCD;
(with A. Patel and F. Fucito).
Physics Letters **B131** (1983) 169.
- [6] Extended Operators for Mesons in Lattice QCD;
(with A. Patel).
Physics Letters **B131** (1983) 425.
- [7] String Tension, Glueball Masses and Finite Size Effects in Lattice $SU(3)$;
(with A. Patel).
Physics Letters **B138** (1984) 294.
- [8] An Improved Renormalization Group Transformation in 4-Dimensions;
(with R. Cordery and M.A. Novotny).
Physics Letters **B128** (1983) 425.
Citations: 31
- [9] Weak Transitions in Lattice QCD;
(with R.C. Brower, M.B. Gavela and G. Maturana).
Physical Review Letters **53** (1984) 1318.
Citations: 89
- [10] Monte Carlo Renormalization Group for $SU(2)$ Lattice Gauge Theory;
(with R. Cordery, M. Novotny and A. Patel).
Physical Review Letters **53** (1984) 527.
- [11] Monte Carlo Renormalization Group Improved Action for $SU(2)$ Lattice Gauge Theory;
(with A. Patel).
Physical Review Letters **53** (1984) 531.
- [12] Monte Carlo Renormalization Group for $SU(3)$ Lattice Gauge Theory;
(with A. Patel, G. Guralnik, T. Warnock and C. Zemach).
Physical Review Letters **53** (1984) 1721.
Citations: 40

- [13] Monte Carlo Renormalization Group Analysis of SU(2) and SU(3) Gauge Theories;
(with A. Patel).
Proceedings of the Argonne National Laboratory Workshop on Gauge Theory on a Lattice; Argonne 1984.
- [14] The Nature of the Transition in $d = 4$ U(1) Lattice Gauge Theory;
(with R. Cordery and M. Novotny).
Physics Letters **B172** (1986) 86. Longer version NUB #2654; 1984.
Citations: 39
- [15] One Loop Lattice Vacuum Energy;
(with G. Kilcup and S. Sharpe).
Physics Letters **B147** (1984) 339.
- [16] Monte Carlo Renormalization Group Investigations of SU(2) Lattice Gauge Theory;
(with A. Patel).
Nuclear Physics **B251** [FS13] (1985) 789.
Citations: 33
- [17] The Non-perturbative Beta-function for the SU(2) Lattice Gauge Theory;
(with S. Otto and A. Patel).
Physics Letters **B159** (1985) 143.
- [18] The Non-perturbative Beta-function for the SU(3) Lattice Gauge Theory;
(with G. Guralnik, A. Patel, T. Warnock and C. Zemach).
Physics Letters **B161** (1985) 352.
- [19] Improved Monte Carlo Renormalization Group:
Proceedings of the Tallahassee Conference on Lattice Gauge Theory, World Scientific Publishing (1985).
- [20] Solving QCD Using Monte Carlo Renormalization Group Method;
(with A. Patel),
Proceedings of APS Division of Particles and Fields Meeting; Santa Fe, New Mexico; 1984. World Scientific Publishing (1985).
- [21] The SU(2) Deconfinement Temperature on a BCT Lattice;
(with W. Celmaster, E. Kovacs and F. Green).
Physical Review **D33** (1986) 3022.
- [22] The Deconfinement Transition and MCRG;
(with G. Guralnik, A. Patel, C. Zemach and T. Warnock).
Proceedings of Conference on Quark Confinement and Liberation: University of California, Berkeley; World Scientific, 1985.
- [23] Epsilon Beyond the Naive Mass Spectrum;
(with G. Kilcup, S. Sharpe, G. Guralnik, A. Patel and T. Warnock).
Physics Letters **B164** (1985) 347.
Citations: 36
- [24] Monte Carlo Renormalization Group: A Review.
Lattice Gauge Theory 85, Plenum Press 1986.

- [25] An Improved Estimate of Scalar Glueball Mass;
(with G. Guralnik, G. Kilcup, A. Patel, S. Sharpe).
Physical Review Letters **57** (1986) 1288.
Citations: 50
- [26] Improved Actions, Redundant Operators and Scaling in Lattice SU(3);
(with A. Patel).
Physics Letters **B183** (1987) 193.
- [27] Weak Interaction Matrix Elements with Staggered Fermions I:
Theory and a Trial Run;
(with G. Guralnik, G. Kilcup, A. Patel, and S. Sharpe).
Nuclear Physics **B286** (1987) 253.
Citations: 56
- [28] Clear Evidence for a First Order Chiral Transition in QCD;
(with G. Guralnik, G. Kilcup, A. Patel and S. Sharpe).
Physical Review Letters **57** (1986) 2621.
Citations: 70
- [29] The Hadron Spectrum on a $18^3 \times 42$ lattice ;
(with G. Guralnik, G. Kilcup, A. Patel, S. Sharpe and T. Warnock).
Physical Review **D36** (1987) 2813.
Citations: 93
- [30] More on the first order chiral symmetry transition in QCD.
Proceedings of the International Conference, Brookhaven, USA
Lattice Gauge Theory 1986, Plenum Press 1987.
- [31] $\frac{\epsilon'}{\epsilon}$ from the lattice;
(with G. Guralnik, G. Kilcup, A. Patel, S. Sharpe).
Physics Letters **B192** (1987) 149.
Citations: 37
- [32] Food for Thought: Five Lectures on Lattice Gauge Theory.
Lectures at China Center of Advanced Science and Technology Symposium/Workshop
on Lattice Gauge Theory Using Parallel Processors, Gordon and Breach, 1987.
- [33] Introduction to Lattice Gauge Theory.
TASI 87, Santa Fe. World Scientific 1988.
- [34] Exploring Hadron Masses in Lattice QCD with Light Quarks and an Improved
Fermion Action.
(with Ph. de Forcrand, S. Güsken, K.-H. Mutter, A. Patel, K. Schilling, and R. Sommer)
Physics Letters **B200** (1988) 143.
- [35] On The Finite Temperature Transition in QCD.
(with G. Guralnik, G. Kilcup, A. Patel, S. Sharpe).
Physics Letters **B201** (1988) 503.
- [36] The Hybrid Monte Carlo algorithm and the Chiral Transition.
Field Theory on the Lattice, Seillac, France, Sept. 1987, *Nuclear Physics (Proc. Supp.)*
4 (1988) 562.

- [37] The β -function for pure gauge SU(3).
(with G. Kilcup, A. Patel and S. Sharpe)
Physics Letters **B211** (1988) 132.
Citations: 27
- [38] Tuning the Hybrid Monte Carlo Algorithm.
(with G. Kilcup and S. Sharpe)
Physical Review **D38** (1988) 1278.
Citations: 65
- [39] The finite temperature transition for QCD with heavy quarks.
(with G. Kilcup and S. Sharpe)
Physical Review **D38** (1988) 1288.
- [40] Comparison of update algorithms for pure gauge SU(3).
(with G. Kilcup, A. Patel, S. Sharpe and P. de Forcrand)
Modern Physics Letters **A3** (1988) 1367.
Citations: 32
- [41] An improved fermion action from block diagonalization.
(with S. Güsken, K-H. Mütter, A. Patel, R. Sommer, and K. Schilling)
Nuclear Physics **B314** (1989) 63.
- [42] Simulating QCD with dynamical Wilson and Staggered fermions.
1988 International Symposium LATTICE 88, Fermilab, Sept. 1988, *Nuclear Physics* **B (Proc. Suppl.)** **9** (1989) 473.
- [43] QCD with dynamical Wilson fermions.
(with C. Baillie, G. Guralnik, G. Kilcup, A. Patel and S. Sharpe)
Physical Review **D40** (1989) 2072.
Citations: 77
- [44] Sea quarks and the hadron spectrum.
(with Apoorva Patel, Gregory W. Kilcup, Stephen R. Sharpe)
Physics Letters **B225** (1989) 398.
- [45] Lattice calculation of the Kaon B-parameter.
(with Gregory W. Kilcup, Apoorva Patel, Stephen R. Sharpe)
Physical Review Letters **64** (1990) 25.
Citations: 103
- [46] QCD spectrum from the lattice.
HADRON 89, Ajaccio, France.
Edited by F. Binon et.al., Editions Frontieres 1989, page337
- [47] The Renormalization Group and lattice QCD.
Lectures at Sixth TASI in Elementary Particle Physics, Boulder, Colorado, June 1989.
From Actions to Answers, World Scientific 1990.
- [48] Hadron spectrum from the lattice.
Plenary talk at LATTICE 89, Capri, Italy
Nuclear Physics **B (Proc. Suppl.)** **17** (1990) 70.

- [49] Lattice Calculation of Electroweak Amplitudes;
(with C. Bernard, R. Gupta, G. Kilcup and A. Soni)
Int. Jour. of Supercomputer Applications, Vol. 4, Number 3, p. 61
- [50] Exploring glueball wavefunctions on the lattice.
(with C. Baillie, G.W. Kilcup, Apoorva Patel, Stephen R. Sharpe)
Physical Review **D43** (1991) 2301.
Citations: 35
- [51] QCD with dynamical Wilson fermions.
LATTICE 90, Tallahassee, Florida.
Nuclear Physics B (Proc. Suppl.) **20** (1991) 385.
- [52] The quenched spectrum with Staggered fermions.
(with G. Guralnik, G.W. Kilcup, Stephen R. Sharpe)
Physical Review **D43** (1991) 2003.
Citations: 77
- [53] A calculation of the pion's quark distribution amplitude in lattice QCD with dynamical fermions.
(with D. Daniel and D. Richards)
Physical Review **D43** (1991) 3715.
Citations: 59
- [54] QCD with dynamical Wilson fermions II.
(with C. Baillie, R. Brickner, G. Kilcup, A. Patel and S. Sharpe)
Physical Review **D44** (1991) 3272.
Citations: 70
- [55] Lattice calculation of the $I = 2$ pion scattering length.
(with G. Kilcup and S. Sharpe)
Nuclear Physics **B383** (1992) 309.
Citations: 61
- [56] Phenomenology with Wilson fermions using smeared sources.
(with D. Daniel, G. Kilcup, A. Patel and S. Sharpe)
Physical Review **D46** (1992) 3130.
Citations: 47
- [57] The Kaon B parameter with Wilson fermions.
(with D. Daniel, G. Kilcup, A. Patel and S. Sharpe)
Physical Review **D47** (1993) 5113.
Citations: 42
- [58] Matrix Elements with Wilson fermions.
LATTICE 91, Tsukuba, Japan.
Nuclear Physics B (Proc. Suppl.) **26** (1992) 337.
- [59] Scaling, the Renormalization Group and Improved Lattice Actions.
One chapter in the book "**Quantum Fields on the Computer**", Ed. M. Creutz,
World Scientific, 1992.

- [60] Meson form-factors and wave-functions with Wilson Fermions
(with D. Daniel and J. Grandy)
LATTICE 92, Amsterdam, The Netherlands.
Nuclear Physics B (Proc. Suppl.) **30** (1993) 419.
- [61] $I = 2$ pion scattering amplitude with Wilson Fermions.
(with A. Patel and S. Sharpe)
Physical Review **D48** (1993) 388.
Citations: 59
- [62] Bethe-Salpeter amplitudes and density correlations for mesons with Wilson fermions.
(with D. Daniel and J. Grandy)
Physical Review **D48** (1993) 3330.
- [63] Calculations of hadronic matrix elements using lattice QCD.
1993 Mardi Gras Conference on “High Performance Computing and its applications in the Physical Sciences”, World Scientific, 1994.
- [64] Semi-leptonic form-factors of heavy-light mesons from lattice QCD.
(with T. Bhattacharya and D. Daniel)
hep-lat/9310007
- [65] A pot-pourri of results in QCD from large lattice simulations on the CM5.
(with T. Bhattacharya)
LATTICE 93, Dallas, Texas.
Nuclear Physics B (Proc. Suppl.) **34** (1994) 341.
- [66] Geometric measurement of topological susceptibility on large lattices.
(with J. Grandy)
LATTICE 93, Dallas, Texas
Nuclear Physics B (Proc. Suppl.) **34** (1994) 164.
- [67] Matrix Elements of the Singlet Axial Current in the Proton.
(with J. Mandula)
Physical Review **D50** (1994) 6931.
e-print arXiv:hep-lat/9402018
- [68] Semi-leptonic form-factors from lattice QCD
(with T. Bhattacharya)
Proceedings of The Albuquerque Meeting, 8th meeting of the Division of Particles and Fields of the American Physical Society.
Ed. Sally Seidel, World Scientific, 1995.
- [69] Chiral limit of QCD.
LATTICE 94, Bielefeld, Germany.
Nuclear Physics B (Proc. Suppl.) **42** (1995) 85.
- [70] Phenomenology from 100 large lattices
(with T. Bhattacharya)
LATTICE 94, Bielefeld, Germany.
Nuclear Physics B (Proc. Suppl.) **42** (1995) 935.

- [71] Topological density and Instantons on the lattice.
(with J. Grandy)
LATTICE 94, Bielefeld, Germany.
Nuclear Physics B (Proc. Suppl.) **42** (1995) 246.
e-print arXiv:hep-lat/9501009
- [72] Hadron Spectrum with Wilson Fermions
(with T. Bhattacharya, G. Kilcup, and S. Sharpe)
Physical Review D **53** (1996) 6486.
e-print arXiv:hep-lat/9512021
Citations: 65
- [73] Decay Constants with Wilson Fermions at $\beta = 6.0$
(with T. Bhattacharya)
Physical Review D **54** (1996) 1155.
e-print arXiv:hep-lat/9510044
Citations: 22
- [74] Testing the chiral behavior of the hadron spectrum.
(with T. Bhattacharya and S. Sharpe)
LATTICE 95, Melbourne, Australia.
Nuclear Physics B (Proc. Suppl.) **47** (1996) 549.
e-print arXiv:hep-lat/9512005
- [75] Lattice analysis of semi-leptonic form factors.
(with T. Bhattacharya)
LATTICE 95, Melbourne, Australia.
Nuclear Physics B (Proc. Suppl.) **47** (1996) 481.
e-print arXiv:hep-lat/9512007
- [76] Status report on weak matrix element calculations.
(with T. Bhattacharya)
LATTICE 95, Melbourne, Australia.
Nuclear Physics B (Proc. Suppl.) **47** (1996) 473.
e-print arXiv:hep-lat/9512006
- [77] Matrix elements of 4-fermion operators and B-parameters with Wilson Fermions
(with T. Bhattacharya and S. Sharpe)
Physical Review D **55** (1997) 4036.
e-print arXiv:hep-lat/9611023
Citations: 115
- [78] Comparison of Inversion Algorithms for Wilson Fermions on the CM5.
(with T. Bhattacharya, and G. Kilcup)
e-print arXiv:hep-lat/9605029
Los Alamos Preprint Number LA-UR-96-1115.
- [79] Light Quark Masses from Lattice QCD.
(with T. Bhattacharya)
Physical Review D **55** (1997) 7203.
e-print arXiv:hep-lat/9605039.
Citations: 115

- [80] The Extraction of Light Quark Masses From Sum Rule Analyses of Axial and Vector Current Ward Identities
(with T. Bhattacharya and K. Maltman)
Physical Review D **57** (1998) 5455.
e-print arXiv:hep-ph/9703455
Citations: 31
- [81] Light quark masses and the CP violation parameter ϵ'/ϵ
(with T. Bhattacharya)
Nuclear Physics B (Proc. Suppl.) **53** (1997) 292.
e-Print arXiv:hep-lat/9609046
- [82] Staggered fermion matrix elements using smeared operators
(with G. Kilcup and S. Sharpe)
Physical Review D **57** (1997) 1654.
e-Print arXiv:hep-lat/9707006.
Citations: 65
- [83] B-parameters of 4-fermion operators from lattice QCD
Nuclear Physics B (Proc. Suppl.) **63A-C** (1998) 278.
e-print arXiv:hep-lat/9710090.
- [84] Advances in the determination of Quark Masses
(with T. Bhattacharya)
Nuclear Physics B (Proc. Suppl.) **63A-C** (1998) 95.
e-print arXiv:hep-lat/9710095
- [85] Quark Masses, B-parameters, and CP violation parameters ϵ and ϵ'/ϵ
International Conference Orbis Scientiae 1997 II *Physics of Mass*, Pages 177-194,
Miami Beach, Florida, December, 1997. Edited by B. Kursunoglu, S. Mintz, A.
Perlmutter, Plenum Press, 1998.
e-print arXiv:hep-ph/9801412.
- [86] B Meson Decay Constants From NRQCD.
(with A. Ali Khan, T. Bhattacharya, S. Collins, C. Davies, C. Morningstar,
J. Shigemitsu, and J. Sloan)
Physics Letters B **427** (1998) 132
e-Print arXiv:hep-lat/9801038
Citations: 42
- [87] Introduction to Lattice QCD.
LXVIII Les Houches Summer School *Probing the Standard Model of Particle Interactions*, July 28 - Sept 5, 1997, Eds. R. Gupta, A. Morel, E. de Rafael and F. David,
North-Holland, 1999.
e-Print arXiv:hep-lat/9807028
- [88] Wilson versus Clover fermions: A case for improvement
Lattice 98, Nuclear Physics B (Proc. Suppl.) **73** (1999) 321
e-Print arXiv:hep-lat/9810016.

- [89] Non-perturbative Renormalization Constants using Ward Identities
(with T. Bhattacharya, S. Chandrasekharan, W. Lee, and S. Sharpe)
Lattice 98, Nuclear Physics B (Proc. Suppl.) **73** (1999) 276
e-Print arXiv:hep-lat/9810018.
- [90] Non-perturbative Renormalization Constants using Ward Identities
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- [95] Order a improved renormalization constants
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- [98] Non-perturbative improvement of bilinears in unquenched QCD.
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(with Tanmoy Bhattacharya, Weonjong Lee, Stephen Sharpe)
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- [101] Improvement and Renormalization Constants in $O(a)$ Improved Lattice QCD
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- [102] Renormalization Constants using Quark States in Fixed Gauge
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(with T. Bhattacharya, W. Lee, and S. Sharpe)
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(with Weonjong Lee, Tanmoy Bhattacharya, George T. Fleming, Gregory Kilcup, Stephen R. Sharpe)
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- [116] Scaling behavior of discretization errors in renormalization and improvement constants
(with Tanmoy Bhattacharya, Weonjong Lee, Stephen Sharpe)
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- [117] Improved bilinears in lattice QCD with non-degenerate quarks
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PUBLICATIONS IN STATISTICAL MECHANICS

- [S1] Monte Carlo Estimates of the Mass Gap of the O(2) and O(3) Spin Models in 1+1 Dimensions; (with G.C. Fox, O. Martin and S. Otto).
Nuclear Physics **205** [FS5] (1982) 188.
Citations: 59
- [S2] Massgap and Scaling in the O(3) Sigma Model in 1+1 Dimension.
CALT-68-1010, and in Ph.D. Thesis (1982).
- [S3] Monte Carlo Renormalized Hamiltonian;
(with R. Cordery)
Physics Letters **A105** (1984) 415.
Citations: 18
- [S4] Clear Evidence of Redundant Operators in Monte Carlo Studies of the Ising Model;
(with R. Shankar).
Physical Review **B32** (1985) 6084.
- [S5] Dealing with Truncation in Monte Carlo Renormalization Group Calculations;
(with R. Shankar and G. Murthy).
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- [S6] Open Problems in Monte Carlo Renormalization Group: Application to Critical Phenomena.
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- [S7] The phase transition in the 2 - d XY model.
(with J. DeLapp, G.C. Fox, C. Baillie, J. Apostolakis)
Physical Review Letters **61** (1988) 1996.
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- [S8] Critical behavior of the 2-d XY model.
(with C. Baillie)
Physical Review **B45** (1992) 2883.
Citations: 115
- [S9] Monte Carlo Renormalization Group studies of the 3-d Ising Model.
(with C. Baillie, K. A. Hawick and G. S. Pawley)
Physical Review **B45** (1992) 10438.
Citations: 125
- [S10] Two-temperature non-equilibrium Ising models: Critical behavior and universality.
(with P. Tamayo and F. J. Alexander)
Physical Review **E50** (1994) 3474.
- [S11] Critical Exponents of the 3-D Ising Model.
(with P. Tamayo)
International Journal of Modern Physics **C7** (1996), 305-319.
e-print arXiv:cond-mat/9601048.
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- [S12] Behavior of the finite-sized, three-dimensional, Ising model near the critical point.
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Computer Simulation Studies in Condensed Matter Physics IX, Eds. D.P.Landau,
K.K. Mon, H.B. Schüttler, Springer Proceedings in Physics **82**, Pages 162-166.

PUBLICATIONS IN COMPUTATIONAL SCIENCE

- [C1] Nearest Neighbor Concurrent Processor;
(with E. Benedictis, E. Brooks, G. C. Fox, O. Martin, S. Otto).
CALT-68-867, (1981).
- [C2] QCD with dynamical fermions on the Connection Machine;
(with C.F. Baillie, R.G. Brickner, L. Johnsson).
Proceedings of “Supercomputing 89”, Reno, Nevada (ACM Press, New York, 1989)
- [C3] QCD on the Connection Machine.
Proceedings of “Large Scale computing in the 21st Century”, Cape Cod, Oct. 1990.
Ed. Jill P. Mesirov, SIAM 1991
- [C4] Prospects of Solving Grand Challenge Problems.
Proceedings of the workshop on “*Debugging and Performance Tuning for Parallel Computing Systems: Toward a unified Environment*”, Cape Cod, Oct 3-5, 1994. Ed. Ann Hayes and Margaret Simmons.
- [C5] The Petaflops Router: harnessing FPGAs and Accelerators for High Performance Computing;
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“*2009 Symposium on Application Accelerators in High Performance Computing*”, University of Illinois, Urbana Champaign, Jul 27, 2009 - Jul 31, 2009

PUBLICATIONS IN COMPUTATIONAL BIOLOGY

- [B1] Timing the Ancestor of the HIV-1 Pandemic Strains
(with T. Bhattacharya, F. Gao, B. Hahn, A. Lapedes, B. Korber, M. Mauldoon, J. Theiler, S. Wolensky)
Science, **288** (2000) 1789.
Citations: 298
- [B2] Search for the origin of HIV and AIDS
(with T. Bhattacharya, F. Gao, B. Hahn, A. Lapedes, B. Korber, M. Mauldoon, J. Theiler, S. Wolensky)
Science, **289** (2000) 1140.

Publications and Invited Talks on Energy and Energy Security

- [ES1] Will there be enough energy for all in the 21st century?
Los Alamos National Laboratory Frontiers of Science Lectures, April-May 2006
- [ES2] The future of Energy Security in the 21st century.
American Physical Society, DNP Annual Meeting, Nashville, Oct 2006
- [ES3] The future of Energy Security in the 21st century.
American Physical Society, SESAPS Annual Meeting, Williamsburg, Nov 2006
- [ES4] The many faces of the energy challenge.
American Association for Petroleum Landmen, Annual Meeting, Chicago May 11-13, 2008
- [IS4] Gupta, R., “Global Energy Observatory: A one-stop site for information on energy systems, infrastructure and emissions”, EPA 18th Annual International Emission Inventory Conference “Comprehensive Inventories -Leveraging Technology and Resources”; Baltimore, Maryland - April 14 - 17, 2009
Los Alamos Preprint Number LA-UR-09-01804
- [ES5] Global Energy Observatory: a One-stop Site for Information on Energy Systems
“Energy for the 21st Century”, 29th Annual CNLS Conference, May 18-22, 2009, Santa Fe, New Mexico, USA
- [ES6] GEO: An Open Database to Understand, Visualize, and Analyze Global Energy Systems
International School of Scientific Journalism and Communication, 6-9 July 2009, Ettore Majorana Foundation and Center for Scientific Culture Erice, Sicily, Italy.
- [ES7] Promoting India’s Development – energy security and climate security are convergent goals
International Conference on Sustainable Development and Climate Change organized by The Observer Research Foundation (ORF), New Delhi, and Rosa Luxembourg Foundation, Berlin. New Delhi, India, Sept. 24-25, 2009.
LA-UR-09-06014
- [ES8] Development, Energy and Climate Security
(With Harihar Shankar and Sunjoy Joshi)
Seminar 606 (www.india-seminar.com), February 2010, Pages 30-34. A special issue on “Climate Change Conundrum”.
LA-UR-09-06014
- [ES9] Development, Energy Security and Climate Security: Indias Converging Goals
(With Harihar Shankar and Sunjoy Joshi)
Invited contributed book chapter in “Sustainable Development and Climate Change”, Eds S. Joshi and M. Linke, Rupa Publications India, 2010.
LA-UR-09-07450
- [ES10] Global Energy Observatory: a One-stop Site for Information on Energy Systems
Keynote address at the XXIV Rencontres de Physique de La Vallee d’Aoste
To appear in Il Nuovo Cimento B
LA-UR-10-03589

- [ES11] Options for Development and Meeting Electric Power Demand in South Asia
(With Harihar Shankar)
Invited Contribution to Book “South Asia 2060” Editors Adil Najam and Moeed Yusuf, Pardee Center Project, Boston University, 2010.
Invited Contribution to Book “Energy and Society in the Longer Range Future” Editors Cutler Cleveland and Adil Najam, Pardee Center Project, Boston University, 2010.
LA-UR-10-04209

PUBLICATIONS AND INVITED TALKS IN PUBLIC HEALTH

See my website <http://t8web.lanl.gov/people/rajan/AIDS-india/>

- [PH1] The HIV/AIDS Pandemic in India is Real
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/summary.3.99.html>
- [PH2] Dilemmas in the care of patients with AIDS in India
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/dilemma.3.99.html>
A abridged version published in "Issues in Medical Ethics", vol VIII No. 2, April-June, 2000.
- [PH3] HIV/AIDS Poses a Threat to India: A Global Perspective
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/issues.9.99.html>
- [PH4] Health care in India in light of HIV/AIDS and the role of the West
Published in e-forum AIDS-INDIA at <http://groups.yahoo.com/group/AIDS-INDIA/>

<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/healthINDIA.1.00.html>
- [PH5] Thoughts on whether there should be isolated or common wards for HIV+ patients
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/HIVwards.1.00.html>
- [PH6] On the HIV Beat in Bombay
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/beatbombay.2.00.html>
- [PH7] Issues of Blood Safety in India
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/blood.6.00.html>
- [PH8] We need to talk about condoms: A plea to Christian Organizations in India to break their silence
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/christian.html>
- [PH9] Risk Factors and Societal Response to HIV/AIDS in India
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/hivindia2001.html>
- [PH10] The need for a holistic approach to social intervention
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/designing.html>
- [PH11] Contagion and Stability
Participant in a simulated Health Scenario organized by the U.S. Army War College, Carlisle, Pennsylvania, May 2001.
- [PH12] Response to HIV/AIDS – A Universal Policy. My thoughts on what a national policy on controlling HIV/AIDS should be.
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/hivpolicy.html>
- [PH13] BEING A GOOD ROLE MODEL". A talk to parents and teachers in India on the importance of setting a good example.
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/rolemodel.html>
- [PH14] Students as agents of change: tackling societal problems in India
Invited talk at "AIDS-in-India". Conference organized by IHO and the Harvard School of Public Health, Dec 7, 2001
- [PH15] Developing partnerships for improving health in India
Invited talk at "Health and Security". A workshop organized by CBACI, 18 June 2002, Geneva

- [PH16] Reaching kids by being a kid: HIV/AIDS intervention
Invited talk at “UNIDOS 2002” New Mexico Department of Health, Las Cruces, NM
- [PH17] Why has the number 4 million HIV+ failed to elicit the required response in India?
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/documentation.html>
- [PH18] Five questions on HIV/AIDS in India following the National Parliamentarians Forum, July 2003
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/fivequestions.html>
- [PH19] Should commercial sex be designated sex work or prostitution in the era of HIV/AIDS?
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/sex-work.html>
- [PH20] Thoughts on the workshop “Land, Community and Governance” organized in Udaipur by Seva-Mandir during 12-13 September, 2003. Published in the Seva-Mandir Newsletter, Volume October 2003 - March 2004.
<http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/SM03conf.html>
- [PH21] Risky Sex, Addictions, and Communicable Diseases in India: Implications for Health, Development and Security.
Published as a special monograph (Number 9 in the series on Health and Security) by Chemical and Biological Arms Control Institute, Washington D.C., September 2004
http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/Gupta_HIV_India.pdf
- [PH22] “Teen Freedoms, Sexual Health, and Making the Right Choices”
Keynote address at “UNIDOS 2004” New Mexico Department of Health, Las Cruces, NM, October 2004.
- [PH23] “HIV/AIDS and the Future of the Poor, Illiterate and Marginalized Populations”
Plenary talk at the International Symposium “The future of Life and the Future of Our Civilization”, Frankfurt, May 2005. Proceedings Pages 379-400, Ed. Vladimir Burdyuzha, Springer, 2006. Also available at
http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/HIV_poor_future.pdf
- [PH24] “HIV/AIDS, a thermometer for the Future of the Poor: India a case study”
Colloquium at the Morrison Institute, Stanford University, January 2006.
- [PH25] “Teen Freedoms, Sexual Health, and Making the Right Choices”
Keynote address at “UNIDOS 2006” New Mexico Department of Health, Las Cruces, NM, November 2006.
- [PH26] “HIV, Empowerment, and how concerned people can contribute”
Invited talk at “The Feminine Epidemic: Global Intersections of Women and HIV/AIDS”
A conference presented by the Student Global AIDS Campaign at University of Chicago, 26 May 2007. (LAUR-07-3557)
http://t8web.lanl.gov/people/rajan/Gupta_HIV_SW.pdf

PUBLICATIONS AND INVITED TALKS IN EDUCATION

- [E1] Strategic Research at Los Alamos
(with D. Watkins)
Los Alamos Science, Volume Number 28 “Celebrating 60 years”, 2003.
- [E2] Education: A Key to Development: Lessons from India
Plenary talk at the International Conference *Models of Universities in the Arab World*,
Beirut, Lebanon, 23-24 October 2003.
http://t8web.lanl.gov/people/rajan/AIDS-india/MYWORK/education_India_Arab.pdf

PUBLICATIONS AND INVITED TALKS IN INFORMATION SCIENCE

- [IS1] Gupta, R., “Mapping the global energy system using Google Earth, Wikis, and Open Sources”, Interlab 2007 Workshop, Los Alamos, October 1-3, 2007.
(<http://www.lanl.gov/interlab/>)
- [IS2] Gupta, R., “Volunteered Information: part of a toolkit to address complex global challenges”, Workshop on Volunteered Geographic Information, University of California Santa Barbara, 13-14 December, 2007, (<http://ncgia.ucsb.edu/projects/vgi/>)
- [IS3] Gupta, R., “Mapping, Monitoring and Modeling the Global Energy System”, Workshop on Volunteered Geographic Information, University of California Santa Barbara, 13-14 December, 2007, (<http://ncgia.ucsb.edu/projects/vgi/>)
- [IS4] Gupta, R., “Global Energy Observatory: A one-stop site for information on energy systems, infrastructure and emissions”, 18th Annual International Emission Inventory Conference “Comprehensive Inventories -Leveraging Technology and Resources”; Baltimore, Maryland - April 14 - 17, 2009
<http://www.epa.gov/ttn/chief/conference/ei18/session4/gupta.pdf>
Los Alamos Preprint Number LA-UR-09-01804

MAJOR REVIEW TALKS AND SUMMER SCHOOL LECTURES IN HIGH ENERGY PHYSICS AND COMPUTATIONAL PHYSICS

- [1] Monte Carlo Renormalization Group in Lattice Gauge Theories.
APS Spring Meeting, Baltimore, Maryland; 1985.
- [2] Monte Carlo Renormalization Group: A Review.
Plenary talk at the *International Conference on Lattice Gauge Theories*. Wuppertal, West Germany; 1985.
- [3] Open Problems in Monte Carlo Renormalization Group: Application to Critical Phenomena.
31st Annual Conference on Magnetism and Magnetic Materials, Baltimore Maryland, 1986.
- [4] Food for Thought: Five Lectures on Lattice Gauge Theories.
1st CCAST Symposium/Workshop on Lattice Gauge Theory Using Parallel Computers, Beijing, Peoples Republic of China, 1987.
- [5] Introduction to Lattice Gauge Theory.
Lectures at the Fourth TASI in Elementary Particle Physics, Santa Fe, New Mexico, July 1987.
- [6] The Renormalization Group and lattice QCD.
Lectures at Sixth TASI in Elementary Particle Physics, Boulder, Colorado, June 1989.
- [7] The finite temperature transition in QCD and the equation of state near T_c .
QUARK MATTER 88, Lennox, Massachusetts (Sept. 1988).
- [8] Status of Lattice QCD (Core lectures).
1989 U.K. Summer Institute in Theoretical Physics, Durham, U.K., August 1989.
- [9] Hadron spectrum from the lattice.
Plenary talk at *International Symposium on Lattice Field Theory, LATTICE89*, Capri, Italy, 1989
Nuclear Physics B (Proc. Suppl.) **17** (1990) 70.
- [10] QCD spectrum from the lattice.
Plenary talk at *HADRON 89*, Ajaccio, France.
Edited by F. Binon et.al., Editions Frontieres 1989, page337
- [11] Scaling, the Renormalization Group and Improved Lattice Actions.
One chapter in the book **Quantum Fields on the Computer**, Ed. M. Creutz, World Scientific, 1992.
- [12] Calculations of matrix elements using lattice QCD.
Mardi Gras '93 Conference *High Performance Computing and its Applications in the Physical Sciences*, Ed Dana Browne, World Scientific 1994.
- [13] Standard Model Phenomenology from the Lattice. Six core lectures at the *XXXIV Cracow Summer School*, Zakopane, Poland, June 1994.
- [14] Chiral limit of QCD.
Plenary talk at the *International Symposium on Lattice Field Theory, LATTICE 88*, Bielefeld, Germany.
Nuclear Physics B (Proc. Suppl.) **42** (1995) 85.
- [15] The chiral behavior of quenched and unquenched QCD.

- International workshop *Lattice QCD and the Structure of matter, Present and Future*, Cartona, Italy, Feb 7- 11, 1995.
- [16] Common trends in multigrid and renormalization group methods.
International conference *Multiscale Phenomena*, Eilat, Israel, Feb 20-24, 1995.
- [17] Status report on weak matrix element calculations.
International Symposium on Lattice Field Theory, LATTICE95, Melbourne, Australia.
Nuclear Physics B (Proc. Suppl.) **47** (1996) 473.
- [18] Critical Exponents of the 3-D Ising Model.
US-Japan Bilateral Seminar, Maui, August 1995.
International Journal of Modern Physics C **7** (1996), 305-319, cond-mat/9601048.
- [19] Quark masses from lattice QCD.
International symposium on *Multiscale Phenomena and their simulation*, Bielefeld, Germany, 1996.
- [20] Light quark masses.
1997 Joint April APS/AAPT meeting, Washington D.C., April, 1997.
- [21] Advances in the determination of Quark Masses
Nuclear Physics B (Proc. Suppl.) **63A-C** (1998) 95.
Plenary talk at *International Symposium on Lattice Field Theory, LATTICE 97*, Edinburgh, U.K..
Los Alamos Preprint Number LA-UR-97-4355.
- [22] Introduction to Lattice QCD.
Core lectures at the LXVIII Les Houches Summer School *Probing the Standard Model of Particle Interactions*, July 28 - Sept 5, 1997, Eds. R. Gupta, A. Morel, E. de Rafael and F. David, North-Holland, 1999.
- [23] Quark Masses, B-parameters, and CP violation parameters ϵ and ϵ'/ϵ
Review talk given at CPMAS 1997, Portugal.
- [24] Quark Masses, B-parameters, and CP violation parameters ϵ and ϵ'/ϵ
in *Physics of Mass* Proceedings of an International Conference on Orbis Scientiae 1997 II, Miami Beach, Florida, December 12–15, 1997. Edited by B. Kursunoglu, S. Mintz, A. Perlmutter, Plenum Press, 1998.
- [25] General Physics Motivations for Numerical Simulations of Quantum Field Theory
Parallel Computing **25** (1999) 1199.
- [26] Prospects of calculating ϵ_K and ϵ' from lattice QCD
KAON 99, Eds. J.L. Rosner and B. D. Winstein, University of Chicago Press, 2001.
- [27] LATTICE QCD
Core lectures at the VIII Mexican School “Particles and Fields”, Oaxaca de Juárez, November 20th – 28th 1998, Eds. J.C. DÓlivo, G.L. Castro, and M. Mondragon, AIP Conference Proceedings 490, 1999.
- [28] “Light quark masses: A status report”,
(with K. Maltman) Review at DPF 2000, The Ohio State University
Int.J.Mod.Phys. A **16S1B** (2001) 591
- [29] Status of B_K from Lattice QCD
Review at the first CKM Unitarity Triangle Workshop, CERN Geneva, 2002

- [30] When will High Performance Computing become a mature tool to think with?
International Workshop on “*Science on Cluster Computers*”,
WE-Heraeus-Seminar, Bad Honnef, Germany, August 22 - 24, 2002.
<http://www.theorie.physik.uni-wuppertal.de/Cluster2002/talks.phtml>
Los Alamos Preprint Number LA-UR-02-6733
- [31] Light Quark Masses from Lattice QCD and QCD Sumrules
Review at the second CKM Unitarity Triangle Workshop, Durham U.K, 2003
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